

REMARKS/ARGUMENTS

Claims 1-8 are canceled without prejudice. Claims 9 and 10 are amended. New claims 19-21 are added. Claims 9-21 are pending in the application. Reexamination and reconsideration of the application, as amended, are respectfully requested.

The present invention relates to a multi-layer circuit board made up of circuit-parts sheets, each containing a circuit-forming pattern which is secured in a photo-cured ceramic sheet and exposed on both surfaces of the ceramic sheet. (Applicant's specification, at 1: 6-13)

CLAIM REJECTIONS UNDER 35 U.S.C. § 103:

Claims 9-18 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Hayashi et al. (U.S. Patent No. 6,143,116) in view of Ogata et al. (U.S. Patent No. 6,159,322). The Applicant respectfully traverses this rejection.

Claim 9 is directed to a method for forming individual circuit-parts sheets, laminating a plurality of sheets together to produce a multi-layer circuit board, and firing the laminate. Claim 9 is as follows:

A method of producing a multi-layer circuit board by preparing a circuit-parts sheet which comprises a photo-cured ceramic sheet and a circuit-forming pattern secured to said sheet and having light-transmitting property through the steps (a) to (e) described below and, then, conducting the steps (f) to (h) described below:

(a) forming the circuit-forming pattern having light-nontransmitting property on a surface of a carrier film having light-transmitting property;

(b) forming a photo-curable ceramic coating layer having a thickness not smaller than the thickness of said circuit-forming pattern and in which said circuit-forming pattern is buried, by applying a photo-curable slurry containing an electrically insulating ceramic material on the surface of the carrier film on which said circuit-forming pattern is formed;

- (c) forming a photo-cured ceramic sheet by photo-curing said photo-curable ceramic coating layer by the irradiation with light from the back surface of said carrier film;
- (d) removing uncured portions of said photo-curable ceramic coating layer by using a developing solution;
- (e) peeling off said carrier film;
- (f) preparing a plurality of pieces of the circuit-parts sheets obtained through the step (e);
- (g) laminating a plurality of pieces of the circuit-parts sheets; and
- (h) firing the laminate thereof.

Applicant respectfully submits that Hayashi cannot render obvious Claim 9, because Hayashi fails to teach or suggest “applying a photo-curable slurry containing an electrically insulating ceramic material on the surface of the carrier film on which said circuit-forming pattern is formed; ...forming a photo-cured ceramic sheet by photo-curing said photo-curable ceramic coating layer by the irradiation with light from the back surface of said carrier film....” (emphasis added).

It is a discovery of the present invention that a photo-curable ceramic slurry may be used to coat a circuit on light-transmitting carrier film which enables creation of a circuit-parts sheet via photo-curing and developing. This enables the production of a circuit-forming pattern secured within a photo-cured ceramic layer (the insulating layer) of substantially the same thickness, so that both surfaces of the circuit-forming pattern are substantially flush with both surfaces of the photo-cured ceramic sheet. See Fig. 2(b) – 2(d).

In contrast, Hayashi is directed to creating circuit-parts sheets in a different manner. Hayashi uses half-cured thermosetting resin as an insulating board. (Hayashi, at 5: 1-13) In Hayashi, a circuit is formed on a separate transfer sheet and then press-adhered into one surface of the insulating board. (Hayashi, at 10: 9-17) Because the circuit is present only at the surface of the insulating board, via

holes must be created through the insulating board and filled with conducting paste to achieve conduction through the board. (Hayashi, at 8: 20-30; Fig. 2(C)) Moreover, Hayashi states that the thickness of the metal foil (corresponding to the thickness of the circuit layer) "is not smaller than .05 times and, particularly, from .1 to 0.25 times as great as the thickness of the insulating board." (Hayashi, at 9: 39-41) If the wiring circuit layer is too thick, "it becomes difficult to bury the conducting layer in the insulating board or the insulating board may be deformed." (Hayashi, at 9: 51-54) Thus, Hayashi requires a substantial difference in thickness between the wiring circuit layer and the insulating layer, whereas the present invention is capable of achieving a circuit and insulating layer of substantially the same thickness.

A second production method disclosed in Hayashi teaches the use of a slurry of thermosetting resin to create the insulating layer, instead of an already half-cured insulating board. (Hayashi, at 13: 6-13) This method still requires press-adhering the relatively thin wiring circuit layer from a transfer sheet onto the surface of the relatively thick insulating board (formed by the slurry after drying). (Hayashi, at 14: 25-30) Thus, neither method disclosed in Hayashi teaches the use of photo-curable slurry to create an insulating layer via photo-curing which enables achievement of a circuit with substantially the same thickness as the insulating layer.

Although Hayashi discloses irradiating the transfer sheet with light in Example 2, this step is directed to reducing the tackiness of the previously applied tackifier which was used to adhere the metal foil to the transfer sheet. (Hayashi, at 15: 62-67; at 16: 12-15) Thus, the irradiation with light did not relate to photo-curing a photo-curable substance acting as the insulating layer.

As the Office noted, Ogata, in column 19, lines 19-25, discloses firing a laminated multi-layer circuit board. However, Ogata does not teach or suggest the use of a photo-curable slurry to form an insulating layer around the circuit-forming pattern via photo-curing.

In light of the foregoing, Applicant respectfully submits that Claim 9 is not obvious over Hayashi in view of Ogata, because neither Hayashi nor Ogata teach or suggest each and every limitation of the claim.

Independent Claims 10 and 18 contain the same limitation as Claim 9, “applying a photo-curable slurry containing an electrically insulating ceramic material on the surface of the carrier film on which said circuit-forming pattern is formed; ...forming a photo-cured ceramic sheet by photo-curing said photo-curable ceramic coating layer by the irradiation with light from the back surface of said carrier film...” (emphasis added). Thus, Applicant respectfully submits that these claims are patentable for the same reasons.

Claim 19 depends from independent Claim 9. Claims 11-17 and Claim 20 depend from independent Claim 10. Claim 21 depends from independent Claim 18. Thus, Applicant respectfully submits that dependent claims 11-17 and 19-21 are patentable for the same reasons. Withdrawal of these rejections is thus respectfully requested.

In view of the foregoing, it is respectfully submitted that the application is in condition for allowance. Reexamination and reconsideration of the application, as amended, are requested.

If for any reason the Examiner finds the application other than in condition for allowance, the Examiner is requested to call the undersigned attorney at the Los Angeles, California telephone number (310) 785-4600 to discuss the steps necessary for placing the application in condition for allowance.

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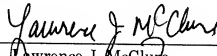
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If there are any fees due in connection with the filing of this response, please charge the fees to our Deposit Account No. 50-1314.

Respectfully submitted,
HOGAN & HARTSON L.L.P.

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